

U.S. Patent Application Serial No. 10/053,712
Amendment dated September 16, 2003
Reply to Office Action of **June 17, 2003**

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (currently amended): A semiconductor device comprising:

a first semiconductor layer formed on a semiconductor substrate;

an outgoing base electrode formed on the first semiconductor layer;

a base layer formed on the first semiconductor layer, connected to the outgoing base electrode
directly at a side surface of the outgoing base electrode, and formed of silicon germanium containing carbon; and

a second semiconductor layer formed on the base layer.

Claim 2 (currently amended): A semiconductor device comprising:

a first semiconductor layer formed on a semiconductor substrate;

an outgoing base electrode formed on the first semiconductor layer;

a base layer formed on the first semiconductor layer, connected to the outgoing base electrode
directly, and formed of silicon germanium containing carbon; and

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a second semiconductor layer formed on the base layer,
the outgoing base electrode and the base layer are formed continuous to each other.

Claim 3 (original): A semiconductor device according to claim 1, wherein
the base layer contains carbon by 0.01% to 6%.

Claim 4 (original): A semiconductor device according to claim 2, wherein
the base layer contains carbon by 0.01% to 6%.

Claim 5 (currently amended): A semiconductor device ~~according to claim 1~~, comprising:
a first semiconductor layer formed on a semiconductor substrate;
an outgoing base electrode formed on the first semiconductor layer;
a base layer formed on the first semiconductor layer, connected to the outgoing base electrode
at a side surface of the outgoing base electrode, and formed of silicon germanium containing carbon;
and
a second semiconductor layer formed on the base layer,

wherein a dopant concentration of the base layer at the part connected to the outgoing base electrode is higher than a dopant concentration of the base layer immediately below the second semiconductor layer.

Claim 6 (currently amended): A semiconductor device according to claim 2, comprising:
a first semiconductor layer formed on a semiconductor substrate;
an outgoing base electrode formed on the first semiconductor layer;
a base layer formed on the first semiconductor layer, connected to the outgoing base electrode,
and formed of silicon germanium containing carbon; and
a second semiconductor layer formed on the base layer,
the outgoing base electrode and the base layer are formed continuous to each other,

wherein a dopant concentration of the base layer at the part connected to the outgoing base electrode is higher than a dopant concentration of the base layer immediately below the second semiconductor layer.

Claim 7 (original): A semiconductor device according to claim 1, wherein
side-etching of an insulation film immediately below the outgoing base electrode is below 0.1
 μm .

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Claim 8 (original): A semiconductor device according to claim 2, wherein side-etching of an insulation film immediately below the outgoing base electrode is below 0.1 μm .

Claim 9 (original): A semiconductor device according to claim 1, wherein the base layer is projected upward beyond the upper surface of the outgoing base electrode by above 0.02 μm .

Claim 10 (original): A semiconductor device according to claim 2, wherein the base layer is projected upward beyond the upper surface of the outgoing base electrode by above 0.02 μm .

Claim 11 (original): A semiconductor device according to claim 1, wherein the first semiconductor layer is a collector layer; and the second semiconductor layer is an emitter layer.

Claim 12 (original): A semiconductor device according to claim 2, wherein
the first semiconductor layer is a collector layer; and
the second semiconductor layer is an emitter layer.

Claim 13 (currently amended): A method for fabricating a semiconductor device comprising
the steps of:

forming an outgoing base electrode with an opening formed [[in]] on a first semiconductor layer
formed on a semiconductor substrate; and

forming a base layer of silicon germanium containing carbon at least in the opening, the base
layer being connected to the outgoing base electrode directly; and

forming a second semiconductor layer on the base layer.

Claim 14 (original): A method for fabricating a semiconductor device according to claim 13,
wherein

the step of forming the base layer includes the step of forming a carbon-content silicon
germanium layer in the opening and on the outgoing base electrode; the step of burying a mask material
in the opening with the carbon-content silicon germanium layer; and the step of etching the
carbon-content silicon germanium layer with the mask material as a mask.

Claim 15 (currently amended): A method for fabricating a semiconductor device[[.]] comprising the steps of:

forming a base layer of silicon germanium containing carbon and an outgoing base electrode connected to the base layer directly on a first semiconductor layer formed on a semiconductor substrate, the base layer and the outgoing base electrode being formed continuous to each other; and

forming a second semiconductor layer on the base layer.

Claim 16 (currently amended): A method for fabricating a semiconductor device according to claim 13, comprising the steps of:

forming an outgoing base electrode with an opening formed on a first semiconductor layer formed on a semiconductor substrate;

forming a base layer of silicon germanium containing carbon at least in the opening;

forming a second semiconductor layer on the base layer; and

further comprising[[:.]] the step of implanting a dopant in the interface between the base layer and the outgoing base electrode.

Claim 17 (currently amended): A method for fabricating a semiconductor device according to ~~claim 14~~, comprising the steps of:

forming an outgoing base electrode with an opening formed on a first semiconductor layer formed on a semiconductor substrate; and

forming a base layer of silicon germanium containing carbon at least in the opening;

forming a second semiconductor layer on the base layer,

wherein the step of forming the base layer includes the step of forming a carbon-content silicon germanium layer in the opening and on the outgoing base electrode; the step of burying a mask material in the opening with the carbon-content silicon germanium layer; and the step of etching the carbon-content silicon germanium layer with the mask material as a mask; and

further comprising the step of implanting a dopant in the interface between the base layer and the outgoing base electrode.

Claim 18 (currently amended): A method for fabricating a semiconductor device according to ~~claim 15~~, comprising the steps of:

forming a base layer of silicon germanium containing carbon and an outgoing base electrode connected to the base layer on a first semiconductor layer formed on a semiconductor substrate, the base layer and the outgoing base electrode being formed continuous to each other;

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forming a second semiconductor layer on the base layer, and
further comprising the step of implanting a dopant in the interface between the base layer and the outgoing base electrode.

Claim 19 (original): A method for fabricating a semiconductor device according to claim 16, wherein

in the step of implanting a dopant, the dopant is implanted obliquely to the surface of the semiconductor substrate.

Claim 20 (original): A method for fabricating a semiconductor device according to claim 17, wherein

in the step of implanting a dopant, the dopant is implanted obliquely to the surface of the semiconductor substrate.